SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC513 – IMAGE PROCESSING AND COMPUTER VISION

III YEAR / V SEMESTER

Unit IV- MORPHOLOGICAL IMAGE PROCESSING

Topic : Basic Morphological algorithm

Convex Hull

A set A is said to be convex if the straight line segment joining any two points in A lies entirely within A.

The convex hull H or of an arbitrary set S is the smallest convex set containing S

Convex Hull

Let B^i, $i = 1, 2, 3, 4$, represent the four structuring elements.

The procedure consists of implementing the equation:

$$X_k^i = (X_{k-1} \circledast B^i) \cup A$$

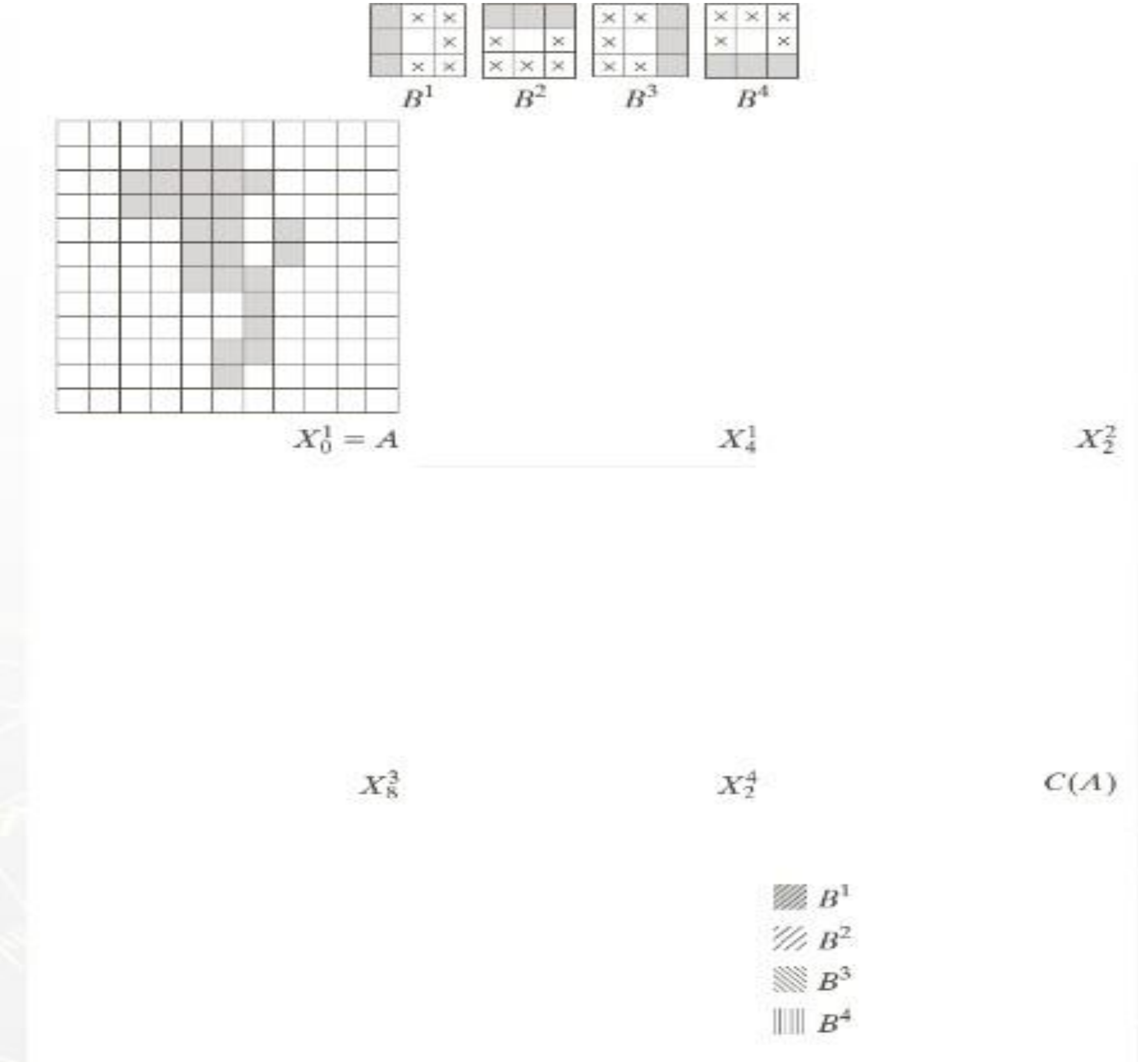
$$i = 1, 2, 3, 4 \quad \text{and} \quad k = 1, 2, 3, \ldots$$

with $X_0^i = A$.

When the procedure converges, or $X_k^i = X_{k-1}^i$, let $D^i = X_k^i$,

the convex hull of A is

$$C(A) = \bigcup_{i=1}^{4} D^i$$



a
b c d
e f g
h

FIGURE 9.19
(a) Structuring elements. (b) Set A. (c)–(f) Results of convergence with the structuring elements shown in (a). (g) Convex hull. (h) Convex hull showing the contribution of each structuring element.

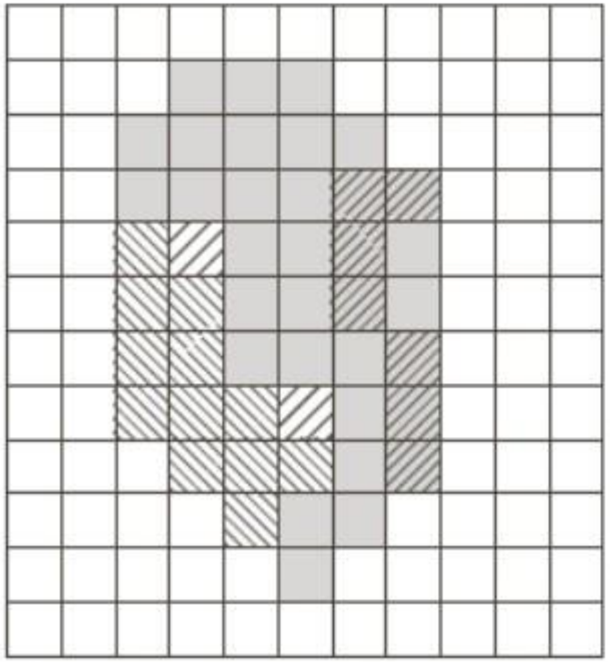


FIGURE 9.20 Result of limiting growth of the convex hull algorithm to the maximum dimensions of the original set of points along the vertical and horizontal directions.

Thinning

The thinning of a set A by a structuring element B, defined

$$A \otimes B = A - (A \circledast B)$$
$$= A \cap (A \circledast B)^c$$

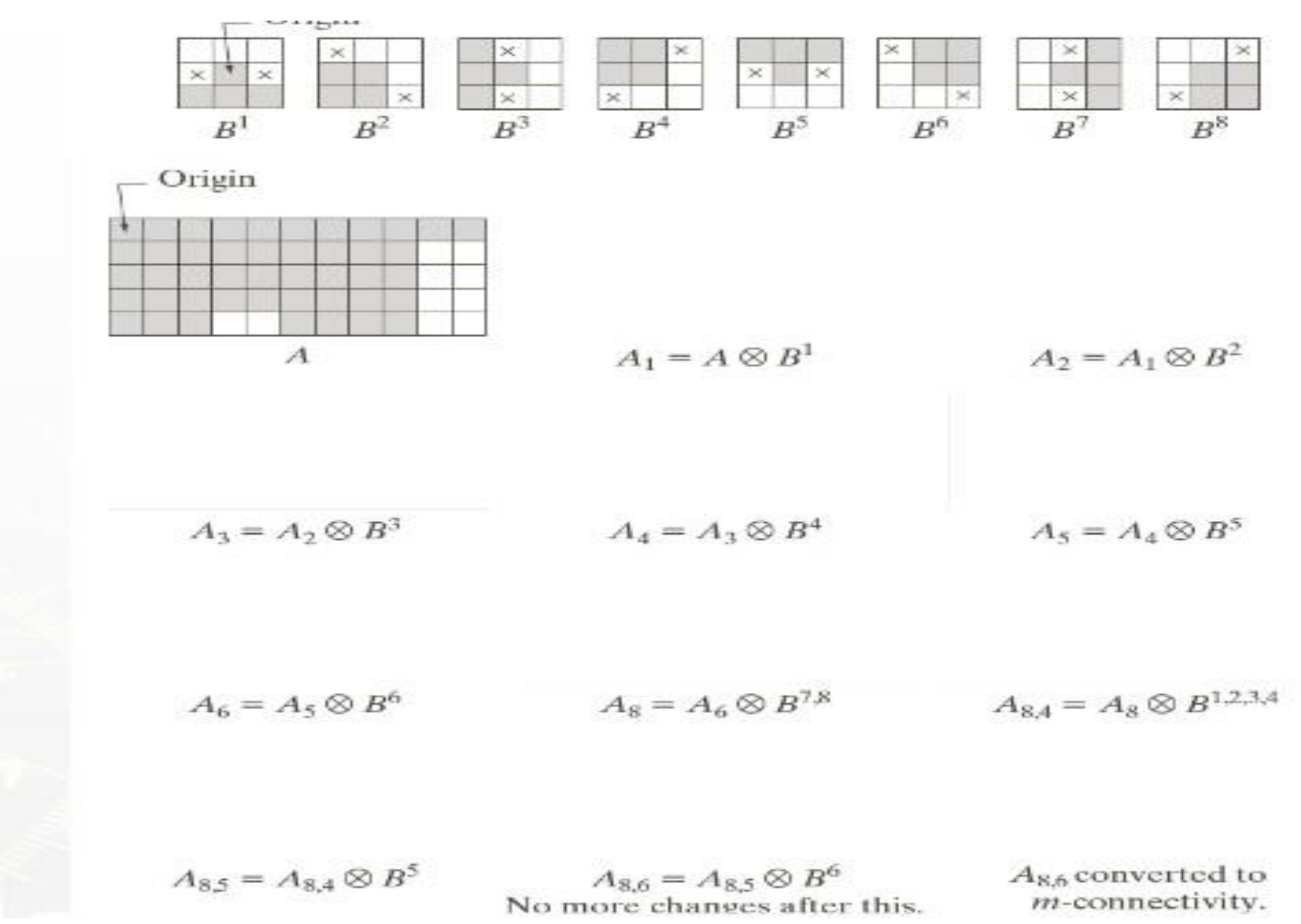
A more useful expression for thinning A symmetrically is based on a sequence of structuring elements:

$$\{B\} = \{B^1, B^2, B^3, \ldots, B^n\}$$

where B^i is a rotated version of B^{i-1}

The thinning of A by a sequence of structuring element $\{B\}$

$$A \otimes \{B\} = ((\ldots((A \otimes B^1) \otimes B^2)\ldots) \otimes B^n)$$



Origin
B1 B2 B3 B4 B5 B6 B7 B8
Origin
A
A1 = A ⊗ B1
A2 = A1 ⊗ B2
A3 = A2 ⊗ B3
A4 = A3 ⊗ B4
A5 = A4 ⊗ B5
A6 = A5 ⊗ B6
A8 = A6 ⊗ B7,8
A8,4 = A8 ⊗ B1,2,3,4
A8,5 = A8,4 ⊗ B5
A8,6 = A8,5 ⊗ B6
No more changes after this.
A8,6 converted to
m-connectivity.

Thickening:

The thickening is defined by the expression

$$A \odot B = A \cup (A \circledast B)$$

The thickening of A by a sequence of structuring element $\{B\}$

$$A \odot \{B\} = ((\ldots((A \odot B^1) \odot B^2)\ldots) \odot B^n)$$

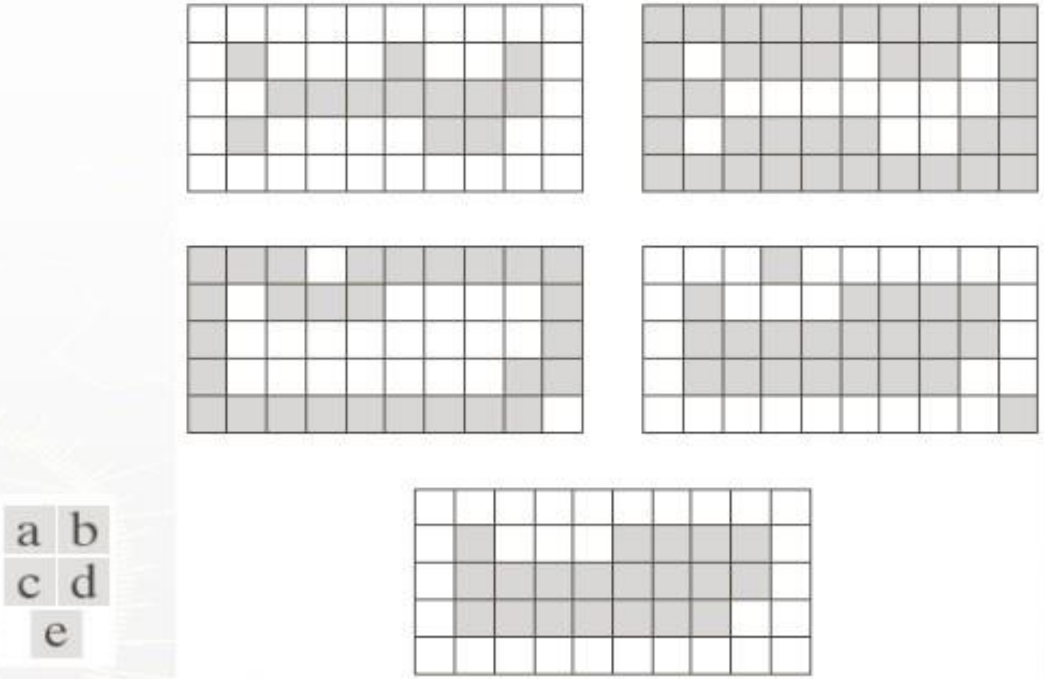


FIGURE 9.22 (a) Set A. (b) Complement of A. (c) Result of thinning the complement of A. (d) Thickened set obtained by complementing (c). (e) Final result, with no disconnected points.

Skeletons

A skeleton, $S(A)$ of a set A has the following properties

a. if z is a point of $S(A)$ and $(D)_z$ is the largest disk centered at z and contained in A, one cannot find a larger disk containing $(D)_z$ and included in A. The disk $(D)_z$ is called a maximum disk.

b. The disk $(D)_z$ touches the boundary of A at two or more different places.

Pruning

Thinning and skeletonizing tend to leave parasitic components

b. Pruning methods are essential complement to thinning and skeletonizing procedures

THANK YOU !!!